
Three New Species in *Salvia* Subgenus *Calosphace* (Lamiaceae) from Mesoamerica

B. B. Klitgaard

Department of Botany, Natural History Museum, Cromwell Road, London SW7 5BD,
United Kingdom. b.klitgaard@nhm.ac.uk

ABSTRACT. Three new *Salvia* L. (Lamiaceae) species, *S. colonica* Standley & Williams ex Klitgaard, *S. univerticillata* Ramamoorthy ex Klitgaard, and *S. whitefoordiae* Klitgaard, were revealed during the study of *Salvia* for the *Flora Mesoamericana* in which 69 *Salvia* species in total are recognized for the *Flora* region. The three species belong to *Salvia* subg. *Calosphace* (Bentham) Epling, and they are endemic to Mesoamerica. In this paper the species are described and illustrated, and their morphological affinities and putative relatives are discussed.

RESUMEN. Durante el estudio de *Salvia* para la *Flora Mesoamericana* se descubrieron tres nuevas especies de *Salvia* L. (Lamiaceae), *S. colonica* Standley & Williams ex Klitgaard, *S. univerticillata* Ramamoorthy ex Klitgaard y *S. whitefoordiae* Klitgaard; en total se reconocen 69 especies de *Salvia* para la región de la *Flora*. Las tres especies pertenecen a *Salvia* subgénero *Calosphace* (Bentham) Epling y son endémicas de Mesoamérica. En este artículo se describen las tres especies como nuevas para la ciencia, se ilustran todas las especies y se discute sus afinidades morfológicas y sus parientes putativos.

Key words: IUCN Red List, Lamiaceae, Mesoamerica, *Salvia*.

Salvia L. (Lamiaceae) consists of at least 900 species and is almost cosmopolitan, with main centers of diversity in Southwest Asia and in Mexico and Central and South America (Harley, 2004). The *Flora Mesoamericana* region stretches from the Yucatán Peninsula and the Mexican state of Chiapas in the north to the Panamanian province of Darién in the south (Davidse, 1994), covering about 737,437 km² in total and with an estimated 17,300 plant species (Knapp et al., 2005). The total number of *Salvia* species in the *Flora Mesoamericana* region is 69 and includes ca. 250 to 300 names previously recognized within *Salvia*. The Chiapas and Guatemalan highlands answer for the highest diversity with about 60 species, while countries relatively lacking in high mountains, like Nicaragua and El Salvador, only have 20 species and 16 species, respectively.

Salvia officinalis L., native to the Mediterranean, is widely used as an herb in cooking; many species are ornamentals (e.g., *S. microphylla* Kunth and *S. splendens* Sellow ex Roemer & Schultes); and some have medicinal properties, e.g., *S. miltiorrhiza* Bunge is used in treatment of cardiac problems (Zhao et al., 1996; Wu et al., 1998; Takahashi et al., 2002).

The revision of *Salvia* subg. *Calosphace* (Bentham) Epling (Epling, 1939) plus nine supplementary papers (Epling, 1940, 1941, 1944, 1947, 1951, 1960; Epling & Mathias, 1957; Epling & Játiva, 1963, 1966) are by far the most comprehensive treatments of New World *Salvia* to date. Since 1939 several regional flora treatments were also published (Nowicke & Epling, 1969 (Panama); Standley & Williams, 1973 (Guatemala); Wood & Harley, 1989 (Colombia); Pool, 2001 (Nicaragua); and Domínguez et al., 2002 (Chiapas)). The *Flora Mesoamericana* treatment, for which this paper is a precursor, will be the most comprehensive treatment of New World *Salvia* since Epling's studies. While working on this treatment, the author examined more than 4000 herbarium specimens from the *Flora Mesoamericana* region, and three new species were revealed.

1. *Salvia colonica* Standley & Williams ex Klitgaard, sp. nov. TYPE: Honduras, Choluteca: road betw. Chinchayote & Comalí, 1100 m, 9 Nov. 1969, A. Molina R. & A. Molina 24589 (holotype, F; isotype, MO). Figure 1P–X.

Salvia colonica Standley & Williams ex Klitgaard; species *S. comayaguanae* Standley similis, sed foliis late ovatis basi obtusis longe angustatis (haud ovatis vel ellipticis basi obtusis vel acutis vel breve angustatis), floribus 12–13 mm longis, albidis vel cyaneis (haud floribus 18–20 mm longis, purpureis) differt.

Erect, aromatic *shrub* to 1.5 m tall; *stems* purplish brown, with dense, white, multicellular, uniseriate trichomes and sessile orange glands. *Leaves* 4–10 × 2.5–6 cm, wide-ovate, membranous, the upper surface dark green, the lower surface pale green, both surfaces pubescent like the stems, the base long-decurrent, the margins serrate, the apex acuminate;

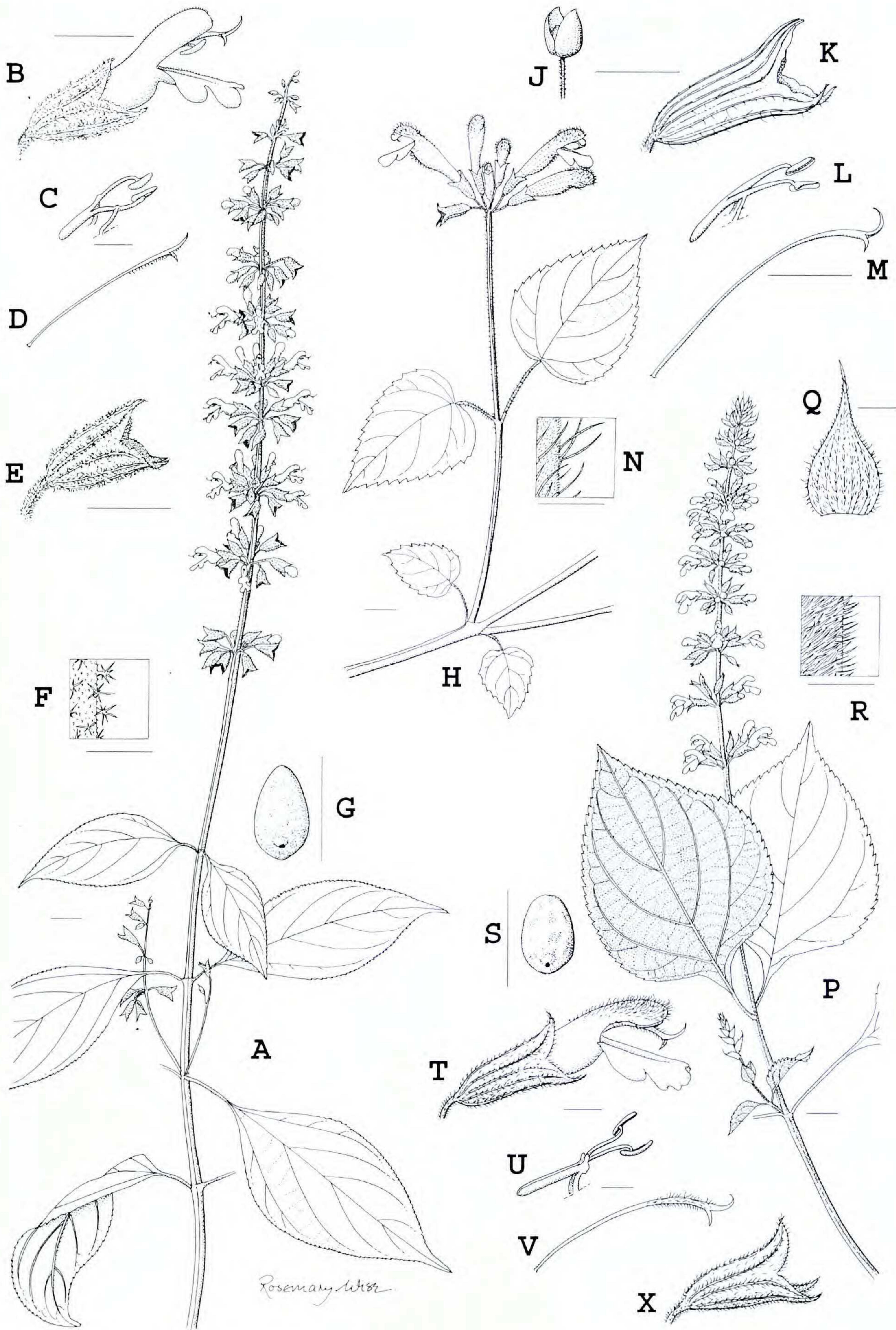


Figure 1. A–G. *Salvia whitefoordiae* Klitgaard. —A. Habit. —B. Flower. —C. Stamens. —D. Style. —E. Calyx. —F. Trichomes. —G. Nutlet. Drawn from E. Cabrera et al. 1906 (MEXU). H–N. *Salvia univerticillata* Ramamoorthy ex Klitgaard. —H. Habit. —J. Bracts. —K. Calyx. —L. Stamens. —M. Style. —N. Trichomes. Drawn from A. Shilom Ton 2001 (F). P–X. *Salvia colonica* Standley & Williams ex Klitgaard. —P. Habit. —Q. Bract. —R. Trichomes. —S. Nutlet. —T. Flower. —U. Stamens. —V. Style. —X. Calyx. Drawn from A. Molina R. & A. Molina 24589 (F). Scale bars = 1 cm in A, B, E, H, L and M (shared), P; 0.5 cm in J and K (shared); 0.2 cm in C and D (shared), G, N, Q, R, S, T and U (shared), V and X (shared); 1 mm in F. Line drawing by Rosemary Wise.

petiole (5–)30–50 mm. *Inflorescences* 5–14 cm, the terminal long and axillary shorter, of dense 10- to 14-flowered verticillasters aggregated into spikes, verticillasters 3–10(–30) mm apart, basal one most distant; axes pubescent like the stems, but more densely; bracts 5–9 × 1.5–3 mm, decussate, ovate, the apex caudate, early caducous. *Flowers* 13–14 mm; bracteoles not seen; pedicels 2–5 mm; *flowering calyx* ca. 8 × 5 mm, 9-nerved (the 3 nerves running into the upper calyx lobe pronounced), campanulate, pubescent like the axes; upper lip ca. 3 mm, the apex triangular, mucronate; lower lip ca. 3 mm, 2-cleft for ca. 1.5 mm, the teeth triangular, the apices mucronate; fruiting calyx slightly accrescent, constricted apically; *corolla* 12–13 mm, white, blue, or blue with a white throat; tube 7–8 mm, glabrous, ventricose below the lower lobe, expapillate, exannulate; upper lip 5–6 mm, hooded, densely pubescent with multicellular trichomes; lower lip 3-lobed, 7–8 × 6–7 mm, reflexed, the lateral lobes pendent, the central lobe largest, the central and lateral lobe margins overlapping; *stamens* ca. 9 mm, included, inserted at the rim of the corolla tube; fertile thecae per stamen 1; connectives of the aborted thecae ca. 4 × 1 mm, expanded, fused, spatulate, toothed ca. 4 mm from the base; *style* ca. 14 mm, exserted, pubescent like the upper corolla lip along its entire length; stigma 2-lobed, pubescent like style, except the stigmatic surface, the adaxial lobe ca. 2 mm, the abaxial lobe ca. 1 mm. *Nutlets* ca. 1.3 × 1 mm, triangular, smooth, speckled green and rusty brown.

Salvia colonica flowers in October and in February to April, and fruit set is observed in October, February to April, and May. The species occurs in Costa Rica, Honduras, and Nicaragua between 700 and 1300 m, occasionally at 2000 m above sea level. It is abundant in secondary pine–oak forests and along roadsides and rivers. Because *S. colonica* is widely distributed, the preliminary conservation assessment places *S. colonica* in the Least Concern (LC) category. Continued habitat destruction throughout its geographical range in the near future, however, may warrant a change in conservation status to the Near Threatened (NT) category (IUCN, 2001).

The species is similar to *Salvia comayaguana* Standley (endemic to Comayagua, Morazán, and Intibuca in Honduras), which has ovate or elliptic leaves with obtuse to acute or short-decurrent bases (vs. wide-ovate leaves with long-decurrent bases in *S. colonica*) and 18–20 mm purple flowers (vs. 12–13 mm blue or white flowers in *S. colonica*).

Standley, in his protologue, notes that *Salvia comayaguana* is similar to *S. lindenii* Benth. *Salvia lindenii* is a synonym of *S. karwinskii* Benth. (Epling, 1939; Standley & Williams, 1973).

Paratypes. COSTA RICA. **Puntarenas**: Monteverde, 20 Feb. 1980, *W. A. Haber* 369 (MO); Cordillera de Tilarán, San Luis, 2 km from the crossing to Santa Elena, 7 Mar. 1994, *J. F. Morales* 2434 (INB, MO). **San José**: Cantón de Aserri, 12 Dec. 1996, *J. Gonzalez, B. Hammel & J. F. Morales* 1326 (INB, MO). HONDURAS. **Choluteca**: Sierra de Colón near San Francisco, 5 Nov. 1946, *L. O. Williams & A. Molina R.* 10798 (F); road betw. El Espinoso & San Marcos de Colón, *A. Molina R.* 23221 (F); vic. of San Marcos de Colón, 12–22 Jan. 1949, *P. C. Standley* 15688 (F). NICARAGUA. **Estelí**: El Bosque archeological site, 10 km SW of Pueblo Nuevo, 1 Nov. 1976, *D. Neill* 1211 (MO); along new road from Hwy. 1 to San Nicolas, 31 Aug. 1978, *W. D. Stevens* 10314 (MO). **León**: betw. El Portillo & Quebrada de Agua, 21 Sep. 1980, *W. D. Stevens & O. M. Montiel* 17905 (CAS, MO).

2. *Salvia univerticillata* Ramamoorthy ex Klitgaard, sp. nov. TYPE: Mexico. Chiapas: Mpio. La Independencia, third ridge along logging road from Las Margaritas to Campo Alegre, 27 Nov. 1980, *D. E. Breedlove & F. Almeda* 47856 (holotype, MEXU; isotypes, CAS, MO). Figure 1H–N.

Salvia univerticillata Ramamoorthy ex Klitgaard: species forma florum sectionis *Cardinalium* Epling speciebus *S. ernesti-vargasii* C. Nelson et *S. karwinskii* Benth. et *S. wagneriana* Polakowski et *S. holwayi* S. F. Blake conveniens, forma foliorum sectionis *Fulgentium* Epling speciebus *S. pulchella* DC. et *S. fulgente* Cavanilles conveniens, sed inflorescentia univerticillata calycis dentibus brevibus obtusis insigniter differt.

Erect perennial herb to 90 cm tall; stems dark green, with dense white glandular trichomes interspersed with short, orange gland-tipped trichomes and 1.5–2.5 mm transparent multicellular trichomes. *Leaves* 2.7–8 × 1.7–6 cm, ovate or cordate, membranous, the upper surface dark green, the lower surface pale gray-green, the venation of both surfaces pubescent like the stems, the lamina with trichomes like the stems above and below, with dense brown sessile glands below, the base rounded or cordate, the margins dentate, the apex acute; petiole (7–)15–45(–60) mm. *Inflorescences* usually at one node, ca. 0.5 cm, terminal, verticillaster 5- to 8-flowered, occasionally with 2 verticillasters ca. 3 cm apart; axes when present violet, pubescent like the stems; bracts ca. 21 × 16 mm, decussate, wide-ovate, the base truncate, early caducous. *Flowers* 29–37 mm; bracteoles not seen; pedicels 4–6 mm; *flowering calyx* 9–11 × 6–7 mm, 15-nerved (the 7 nerves running into the upper lobe not pronounced), campanulate, pubescent like the axes; upper lip ca. 3 mm, triangular, apex mucronate; lower lip ca. 3 mm, 2-cleft for 2 mm, the teeth triangular, the apices cuspidate; fruiting calyx not accrescent, constricted apically; *corolla* 27–35 mm, bright red; tube 20–26 mm, glabrous, ventricose ca. 4 mm from the base, exannulate, with a frilly blade-shaped papilla at ca. 4 mm, and

2 club-shaped projections at ca. 18 mm; upper lip 7–9 mm, hooded, densely pubescent with ca. 1.5 mm red/transparent striped trichomes; lower lip 3-lobed, 8–10 × 7–8 mm, reflexed, the lateral lobes pendant, the central lobe largest; *stamens* 16–19 mm, included, inserted at ca. 2 mm below the rim of the corolla tube; fertile thecae per stamen 1; connectives of the aborted thecae ca. 11 × 2 mm, expanded, fused, toothed ca. 8 mm from the base; *style* 29–37 mm, exerted, glabrous; stigma 2-lobed, glabrous, the adaxial lobe 3–4 mm, the abaxial lobe ca. 1 mm. *Nutlets* ca. 3.2 × 2 mm, flattened, smooth, shiny, dark chocolate brown.

Salvia univerticillata flowers in May, August, and October to March, and fruit set is observed in March. The species has been collected in the central part of Chiapas state in Mexico. It occurs between 1980 and 3000 m above sea level, in primary and disturbed cloud forest with *Quercus* L., *Pinus* L., *Magnolia* L., *Podocarpus* Persoon, and *Olmediella* Baillon. *Salvia univerticillata* is a narrow endemic that grows in very vulnerable habitats. The preliminary conservation assessment of *S. univerticillata* thus places the species in the Vulnerable (VU) category (IUCN, 2001).

The new species shares its floral form with that of other members of section *Cardinales* such as *Salvia ernesti-vargasii*, *S. karwinskii*, *S. wagneriana*, and *S. holwayi*, and the leaf shape with that of *S. pulchella* and *S. fulgens* (both recognized in section *Fulgentes*), but it is uniquely defined by possessing univerticillate inflorescences with the occasional occurrence of two verticillasters per inflorescence, and calyces with relatively short, blunt teeth.

T. Ramamoorthy first recognized that *Salvia univerticillata* represented a new species. He annotated *Breedlove 33513* (MEXU) as a holotype in 1986, but he never published the name. From the same locality is *Breedlove 47856*, which is more complete and more widely distributed in herbaria, and I have therefore selected it as the type.

Paratypes. MEXICO. **Chiapas:** Mpio. Chanal, 4.7 km E of Carmen Yalchuch, 16 Mar. 1995, H. Mejía E., A. Chamé O. & A. Luna G. 115 (MEXU); Mpio. La Independencia, third ridge along logging road from Las Margaritas to Campo Alegre, 18 Feb. 1973, D. E. Breedlove 33513 (CAS, MEXU), 6 May 1973, D. E. Breedlove 34801 (CAS, MEXU, MO), 24 Oct. 1976, D. E. Breedlove 41115 (CAS, MEXU, MO), 20 Nov. 1981, D. E. Breedlove & B. Bartholomew 55681 (CAS, MEXU); Mpio. Tenejapa, W of Tenejapa Center, along trail to Paraiso, 5 Aug. 1964, D. E. Breedlove 6863 (CAS, F); Colonia Achlum, 10 Feb. 1981, D. E. Breedlove 49748 (CAS, MEXU), 12 Dec. 1966, A. Shilom Ton 1743 (F), 7 Feb. 1967, A. Shilom Ton 2001 (F).

3. *Salvia whitefoordiae* Klitgaard, sp. nov. TYPE:
Belize. Cayo: New Maria Camp, 550 m, 20 Apr.

1995, C. Whitefoord 9100 (holotype, BM; isotype, K). Figure 1A–G.

Salvia whitefoordiae Klitgaard; species pilis dendriticis *S. karwinskii* Bentham et *S. ernesti-vargasii* C. Nelson conveniens, sed floribus purpureis brevioribus, inflorescentia longiora differt.

Erect aromatic, woody-based, perennial herb to 2 m tall; *stems* and *leaf venation* sometimes turning violet; stems usually appearing grayish brown with sparse to dense pubescence from multicellular, uniseriate white trichomes and sessile orange glands. *Leaves* (3.3–)5–10(–15) × (0.8–)2.5–4(–6) cm, smallest on axillary inflorescence-bearing branches, elliptic or lanceolate, membranous, the upper surface dark green, the lamina with sparse multicellular, uniseriate trichomes and orange sessile glands, the lower surface dull white, pubescence like the upper surface, denser, the base decurrent, the margins serrate, the apex acuminate or acute; petiole (5–)10–40(–50) mm. *Inflorescences* 10–60 cm, terminal and axillary, the terminal one larger, of dense 4- to 10(to 16)-flowered verticillasters aggregated into spikes, verticillasters 15–49 mm apart, the basal one most distant, otherwise verticillasters tightly packed; axes purple (Belize) or white (Chiapas) from dense violet/white or white dendritic trichomes, these interspersed with sessile orange glands; bracts 4–5 × 2 mm, decussate, wide-ovate, the base truncate, the apex caudate, green, sometimes turning violet, supporting verticillasters in bud. *Flowers* 8–9 mm; bracteoles 2–2.5 × 1–1.5 mm, shaped as the leaves, the margins serrate; pedicels 5–15 mm; *flowering calyx* 6–8 × 4 mm, 9-nerved (the 3 nerves running into the upper calyx lobe pronounced), tubular, whitish green or violet, with pubescence and glands similar to the axes; upper lip 2–4 mm, triangular, the apex caudate; lower lip 2.5–4 mm, 2-cleft for 0.5–1.5 mm, the teeth triangular, the apices mucronate; fruiting calyx accrescent, constricted apically; *corolla* 10–11 mm, purple, occasionally white; tube ca. 7 mm, glabrate, ventricose at ca. 2 mm and ca. 7 mm, with 2 invaginations below the lower lip, without papillae, exannulate; upper lip ca. 3 mm, hooded, the outer surface with ca. 0.2 mm white trichomes; lower lip 3-lobed, 3–4 × 3–4 mm, reflexed, the lateral lobes pendent, the central lobe cordate, larger than laterals; *stamens* ca. 5 mm, exerted above the corolla, the base inserted at the rim of the corolla tube; fertile thecae per stamen 1; connectives of the aborted thecae ca. 3 × 1.5 mm, expanded, fused, spatulate, toothed at ca. 3 mm; *style* 10.5–12 mm, exerted; stigma 2-lobed, minutely pubescent, the adaxial lobe 1.5–2 mm, the abaxial lobe ca. 0.5 mm. *Nutlets* ca. 1.8–2 × 1 mm, flattened, shiny green with dense brown speckles.

Salvia whitefoordiae flowers in December, January, and April, and fruit set is observed in January and March to May. The species has been collected in Belize (the districts of Cayo and Toledo) and the Mexican state of Chiapas (around La Trinitaria and Comitán, and between Ocinango and Palenque). It occurs between 488 (Belize) and 1600 m (Chiapas) above sea level, in primary and disturbed forest dominated by *Quercus*, *Pinus*, and *Liquidambar* L. species, or in forest clearings and along roadsides. Because *S. whitefoordiae* is widely distributed, the preliminary conservation assessment places *S. whitefoordiae* in the Least Concern (LC) category. Continued habitat destruction throughout its geographical range in the near future may, however, warrant that *S. whitefoordiae* change conservation status to the Near Threatened (NT) category (IUCN, 2001).

Salvia whitefoordiae shares dendritic trichomes with only two other Mesoamerican species: *S. ernesti-vargasii* and *S. karwinskii*. While *S. whitefoordiae*, for example, is covered in dendritic trichomes on inflorescence axes and calyces and has 8–9 mm purple flowers aggregated in inflorescences to 60 cm, *S. ernesti-vargasii* and *S. karwinskii* share dendritic trichomes on stems, leaves, inflorescence axes, and calyces and have 26–30 mm bright red flowers aggregated in inflorescences 10–18 cm.

The species was first recognized as new by T. Ramamoorthy (pers. obs. on label notes) but never published. Working on the *Salvia* treatment for *Flora Mesoamericana* has given the author access to much of the *Salvia* material available in the world's herbaria on loan; and since Thomas B. Croat's first collection was recorded in the 1970s, much additional material has been accumulated. This makes it a joy to finally describe this distinct species first pointed out to me by Caroline Whitefoord, one of the most careful observers of morphological characters and an important collector working in the Natural History Museum in London, who collected the plant herself on two occasions in Belize, and after whom *S. whitefoordiae* is named.

The label notes on *Méndez G. 8034* from Chiapas mention that the species is known as "sabal tz'ununtez" in the Tzeltal language.

Paratypes. BELIZE. **Cayo:** S of San Luis & E of Camp Six, 19 Mar. 1967, *J. Dwyer, T. Elias & R. Maxwell* 362 (MO); 2.5 mi. past Guacamallo Bridge, road to Millionario, 29 Jan. 1974, *J. Dwyer & R. Liesner* 12309A (MO); Chiquibul, Monkey Trail, 8 Mar. 1996, *A. K. Monroe, A. How & D. A. Sutton* 1121 (BM, MO); along track betw. Las Cuevas & Monkey Trail, 16 Mar. 1999, *R. Rees, K. Sidwell, G. Reid & R. Sundin* 137 (BM, MEXU, MO); track from Ceibo Chico to Ceibo Grande, 10 Mar. 2000, *M.*

Short, S. Cafferty, A. K. Monroe, M. Peña-Chacorro & A. How 203 (BM, MEXU, MO). **Toledo:** Union Camp, 12 May 1979, *C. Whitefoord* 1673 (BM). MEXICO. **Chiapas:** Mpio. Trinitaria, road La Trinitaria–Lagos de Monte Bello, 13 Apr. 1965, *D. E. Breedlove* 9732 (CAS, MO); Monte Bello Nat. Park, E of Laguna Tzikaw, 23 Jan. 1973, *D. E. Breedlove & Smith* 32243 (CAS, MEXU); Monte Bello Natl. Park along road to Cinco Lagunas, 29 Jan. 1981, *D. E. Breedlove* 49689 (CAS, MEXU); 25 E of Lagos de Monte Bello, 1 Mar. 1982, *E. Cabrera, E. Martínez & H. de Cabrera* 1838 (MEXU); on road pas Lagos de Monte Bello, 15.6 km E of jet. with blacktop, 27 Jan. 1979, *T. B. Croat* 46608 (K, MEXU); Lagos Montebello, along gravel road from blacktop to Dos Lagunas, 3 mi. W of Dos Lagunas, 28 Jan. 1979, *T. B. Croat* 46664 (K); road toward Cinco Lagunas, at 800 m to the N, 6 Mar. 1995, *H. Mejía E. & A. Luna* 61 (MEXU); road La Trinitaria–Cuautemoc, 25 Jan. 1985, *A. Méndez G.* 8034 (MEXU); Cuautemoc, 20 km from Montaña Alta, 15 Mar. 1986, *A. Méndez G.* 8898 (MEXU); 3.5 km E of Tzisco, on road Lagunas de Monte Bello–Bonampak, 8 Apr. 1983, *O. Téllez V. & J. L. Villaseñor R.* 6612 (MO); Mpio. Ocosingo, road Ocosingo–Palenque, 3 March 1982, *E. Cabrera, E. Martínez & H. de Cabrera* 1906 (MEXU).

Acknowledgments. I thank Sandy Knapp and the two reviewers, Christopher R. Hardy and Robin B. Huck, for constructive comments on the manuscript; Norman Robson for help with the Latin diagnoses; Rosemary Wise for the line drawing; and Filipe Dominguez Santana for help with Photoshop. I am grateful to the herbarium curators of the herbaria BM, CAS, F, INB, K, MEXU, and MO for making their material available to me either on loan, as electronic images, or during my visits to their institutions.

Literature Cited

- Davidse, G. 1994. Introducción. Pp. xiii–xiv in G. Davidse, M. Sousa S. & A. O. Chater (editors), *Flora Mesoamericana*, Vol. 6. Alismataceae a Cyperaceae. Universidad Nacional Autónoma de México, México, D.F., Missouri Botanical Garden, St. Louis; The Natural History Museum, London.
- Domínguez-Vázquez, G., B. Berlin, A. E. Castro-Ramírez & E. J. I. Estrada-Lugo. 2002. Revisión de la diversidad y patrones de distribución de Labiatae en Chiapas. *Anales Inst. Biol. Univ. Nac. Autón. México, Bot.* 73: 39–80.
- Epling, C. C. 1939. A revision of *Salvia*: subgenus *Calosphace*. *Feddes Repert. Spec. Nov. Regni Veg., Beih.* 110: 1–383.
- . 1940. Supplementary notes on American Labiatae I. *Bull. Torrey Bot. Club* 67: 509–534.
- . 1941. Supplementary notes on American Labiatae II. *Bull. Torrey Bot. Club* 68: 552–568.
- . 1944. Supplementary notes on American Labiatae III. *Bull. Torrey Bot. Club* 71: 484–497.
- . 1947. Supplementary notes on American Labiatae IV. *Bull. Torrey Bot. Club* 74: 512–518.
- . 1951. Supplementary notes on American Labiatae V. *Brittonia* 7: 129–142.
- . 1960. Supplementary notes on American Labiatae VII. *Brittonia* 12: 140–150.
- & C. Játiva. 1963. Supplementary notes on American Labiatae VIII. *Brittonia* 15: 366–376.

- & ———. 1966. Supplementary notes on American Labiatae IX. *Brittonia* 18: 255–265.
- & M. E. Mathias. 1957. Supplementary notes on American Labiatae VI. *Brittonia* 8(4): 297–313.
- Harley, R. M. 2004. *Salvia* L. Pp. 235–236 in K. Kubizki (editor), *The Families and Genera of Vascular Plants VII*. Springer Verlag, Berlin.
- IUCN. 2001. IUCN Red List Categories and Criteria Version 3.1. Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland.
- Knapp, S., G. Davidse, M. Sousa S., F. Chiang, A. Monro & B. Klitgaard. 2005. Flora Mesoamericana: Linking specimens with floristics. XVII International Botanical Congress, Abstract P0708: 352.
- Nowicke, J. W. & C. C. Epling. 1969. *Salvia* L. Pp. 72–81 in R. E. Woodson & R. W. Schery (editors), *Flora of Panama, Part IX*. *Ann. Missouri Bot. Gard.* 56: 72–81.
- Pool, A. 2001. *Salvia*. Pp. 1179–1186 in W. D. Stevens, C. Ulloa U., A. Pool & O. M. Montiel (editors), *Flora de Nicaragua, Tomo II*. *Monogr. Syst. Bot. Missouri Bot. Gard.* 85.
- Standley, P. C. & L. O. Williams. 1973. *Salvia*. In P. C. Standley, J. A. Steyermark & L. O. Williams (editors), *Flora of Guatemala, Pt. IX, No. 3*. *Fieldiana* 24: 273–301.
- Takahashi, K., X. Ouyang, K. Komatsu, N. Nakamura, M. Hattori, M. A. Baba & J. Azuma. 2002. Sodium tanshinone IIA sulfonate derived from Danshen (*Salvia miltiorrhiza*) attenuates hypertrophy induced by angiotensin II in cultured neonatal rat cardiac cells. *Biochem. Pharmacol.* 64(4): 745–749.
- Wood, J. R. I. & R. M. Harley. 1989. The genus *Salvia* in Colombia. *Kew Bull.* 44: 211–278.
- Wu, Y. J., C. Y. Hong, S. J. Lin, P. Wu & M. S. Shiao. 1998. Increase of vitamin E content in LDL and reduction of atherosclerosis in cholesterol-fed rabbits by a water-soluble antioxidant-rich fraction of *Salvia miltiorrhiza*. *Arterioscl. Thromb. Vasc. Biol.* 18: 481–486.
- Zhao, B. L., W. Jiang, Y. Zhao, J. W. Hou & W. J. Xin. 1996. Scavenging effects of *Salvia miltiorrhiza* in free radicals and its protection for myocardial mitochondrial membranes from ischemiareperfusion injury. *Biochem. Molec. Biol. Int.* 38(6): 1171–1182.